The American Biology Teacher

Vol. 12 OCTOBER, 1950 No. 6

PUBLISHED BY
The National Association of Biology Teachers

Entered as second class matter October 26, 1939, at the post office at Lancaster, Pa., under the Act of March 3, 1879.

To Our Members:

A large part of the success of **The American Biology Teacher** is due to the generous support that our advertisers have given us.

We owe it to ourselves, as educators, to become more familiar with the abundance of excellent teaching aids and devices that these concerns produce.

A post card to any of our advertisers will bring you catalogues or circulars listing many products of real pedagogical interest and value.

If you know of any firm that would benefit by advertising in our journal, notify Managing Editor Betty Lockwood, 15 Gramercy Park, New York 3, N. Y.

NOTICE TO CONTRIBUTORS

Manuscripts for publication in THE AMERICAN BIOLOGY TEACHER should be typewritten, on one side only, on standard white paper, 8½ × 11 inch size, with a margin of at least an inch on all sides. The writer should keep a carbon copy for reference and as insurance against loss of the original in transit.

Articles are scheduled for publication in approximately the order of acceptance of the manuscripts. Generally the journal is tentatively arranged about three or four issues ahead, and there are under consideration at any time enough manuscripts for about two or three more issues. Some space is of course allowed for news items and articles of a seasonal nature. On the average, a manuscript submitted this month may expect to find its way into print, if it is accepted promptly, in about January or February. Many seasonal papers have to be postponed an entire year, simply because the author has not allowed the necessary four to six months that intervenes between acceptance and publication.

For details concerning titling, headings, references, illustrations, etc., consult *Preparation of Manuscripts for Publication*, which appeared in the November, 1949, issue of THE AMERICAN BIOLOGY TEACHER. A limited number of reprints is still available; copies may be obtained from the editor or from the Secretary-Treasurer.

Manuscripts may be sent to the editor-in-chief or to any one of the associate editors. A complete list of the latter appears in each October and February issue.

THE AMERICAN BIOLOGY TEACHER

Publication of the National Association of Biology Teachers.

Issued monthly during the school year from October to May.

Publication Office—N. Queen St. and McGovern Ave., Lancaster, Pa.

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Subscriptions, renewals, and notices of change of address should be sent to the Secretary-Treasurer, John P. Harrold, 110 E. Hines Ave., Midland, Mich. Correspondence concerning advertising should be sent to the Managing Editor.

The entire Staff List will be found in the February and October issues.

Annual membership, including subscription, $2.50, outside United States, $3.00.

The 1950 Cleveland Meeting

THE NATIONAL ASSOCIATION OF BIOLOGY TEACHERS is again meeting with other science teaching organizations at Christmas time. This year's program will be held in Cleveland, December 27 to 30. Headquarters will be at the Hotel Statler. General sessions held jointly with the science teaching affiliates of THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, will occupy most of the program time. The meetings for Thursday, December 28, are being planned by NABT.

Separate meetings of THE NATIONAL ASSOCIATION OF BIOLOGY TEACHERS are scheduled for Friday, December 29.

THE AMERICAN NATURE STUDY SOCIETY will have a meeting on Friday evening. This is open to NABT members.

THE NATIONAL ASSOCIATION OF BIOLOGY TEACHERS luncheon, with Betty Lockwood presiding, will be held at the Allerton Hotel at 12:30 Thursday, December 28.

The program for the various sessions are of course not complete. In skeleton, it will be as follows:

DECEMBER 27

Morning—Outdoor Resources for Learning Science

Afternoon—Using Outdoor Resources to Teach Nature

DECEMBER 28

Morning—Human Resources for Learning Science
—Using Resource People in a Science Program

Afternoon—Program Planning in Biology

DECEMBER 29

Morning—Industrial and Technological Resources for Learning Science

Afternoon—Special Techniques in the Teaching of Biology

DECEMBER 30

Joint Field Trip—American National Study Society and National Association of Biology Teachers

The detailed program will appear in the November issue. Copies of it will also be mailed to all NABT members.

Plan now to be in Clevelaud December 27 to 30.

The American Biology Teacher

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All Out for Conservation

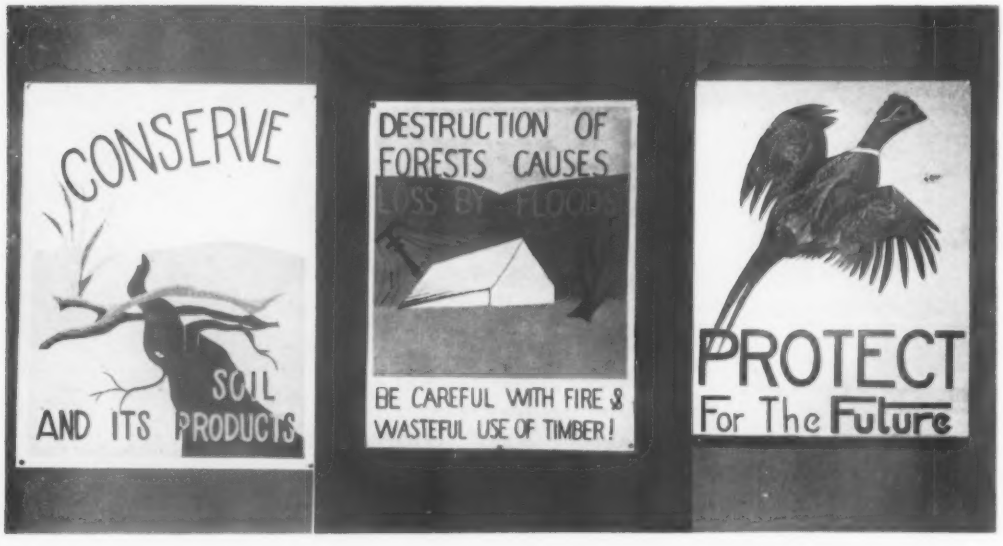
LYDIA BOURNE WALSH
Elmira College, Elmira, New York

Consideration of conservation of natural resources belongs fittingly in the content of some courses in biology where, in the laboratory, a student can determine the water-holding capacities of different types of soils and can observe the relationship between roots and soil particles. In the biology classroom and on the biology field trip he can discuss and note the distribution and balance of plants and animals in nature; their adaptations and their habitats. What consideration can the student who has elected courses in art, English, speech or in modern dance give in the classroom or laboratory to conservation? The question is being answered on the campus of Elmira College, Elmira, New York, where the entire college community undertook a program on conservation of natural resources.

Dr. Lewis Eldred, President of Elmira College, appointed a committee of two members of the faculty and one member of the city of Elmira to study ways and means of making the student body and the citizens of the community more keenly conscious of the problem of conservation of natural resources. The program planned by this committee consisted of three public meetings and of student activities which were directed by members of the faculty. The program required for its success the cooperation of the administration, faculty, library staff, the students, the dietitian and the maintenance staff. Indeed the entire college was included in the program.

The art department sponsored two contests, one in poster work and one in sculpturing. The two weeks that are regularly devoted to poster making in a course in commercial design were used for the designing of posters on the subject of conservation. These posters were entered in a contest and exhibited in the College Library together with plaques which stressed conservation and which had been modeled and fired by students in a course in sculpturing.

Another artistic medium used in the interpretation of the subject of conservation by the students was that of the modern dance. Members of ORCHESIS, the student modern dance club, originated the choreography and presented



Prize-winning posters.

the dance drama, *The Plow that Broke the Plains* under the direction of the Instructor in the Dance. The music was by Virgil Thompson and the recitative by Pare Lorentz. Records were used for the music and students in speech gave the readings. The barefoot dancers wore long-sleeved, princess-styled dresses of two tones of tan or of two tones of green. The only stage property was an artistic representation of a hand-plow. Like the documentary film entitled *The Plow that Broke the Plains,* the student dance drama of the same name told the story of the happenings to the land area that resulted in the Dust Bowl. Neither the instructor in the dance nor the members of ORCHESIS had seen the famous film prior to the presentation of the dance exposition. The dance was presented without the documentary film and also in a program composed of a showing of the film followed immediately by the dance. The music, recitative parts and the story were the same in both the film and the dance.

"Poison", "I Saw as in a Dream", "Whiffenpoophs", "National Ignorance", "River Valley Reconstruction" and "We—the Enemies" were the titles of the three prize-winning short stories and prize-winning essays that were chosen from the entries of two contests in creative writing. The Associate Professor of English directed these contests and the Librarian arranged a special reference collection of books and pamphlets on conservation for the students in English. The same books were in active use by students who prepared a debate and a panel discussion under the direction of a Professor of Speech. The question of the debate was: "Resolved that the granting of power to the Northwestern New York Water Supply Commission by the Legislature is to be condemned." The panel discussion on "Conservation of natural resources is more important to humans for aesthetic reasons than economic" brought together interests from the departments of art, economics and speech.

The first of the three public meetings of the program was an address by Dr. E. Laurence Palmer, Professor of Nature and Science Education, Cornell University, on the subject "Conservation in

New Zealand''. The address was illustrated with kodachrome transparencies which Dr. Palmer had taken when he visited New Zealand as Fulbright Exchange Professor. The talk and photographs indicated what has happened without extensive conservation practices in a short time in a country with few complex problems. Overgrazing by sheep was evident; but some conservation practices could be seen in the contour cultivation of the croplands. The subject of the second meeting was ''Water''. Two sound motion picture films entitled ''Water for a Nation'' and ''Clean Waters'' were shown. ''Water for a Nation'', which was obtained from the United States Department of Agriculture, showed how the farmer depends upon water and how the people of the nation depend upon the farmer. ''Clean Waters'', a film in color, was made by the General Electric Corporation in cooperation with the New York State Conservation Department. The film deals with pollution of water and points out what must be done to check pollution. The third and last of the public meetings was a presentation of the documentary film, ''The Plow that Broke the Plains'' together with the students' original dance drama of the same name.

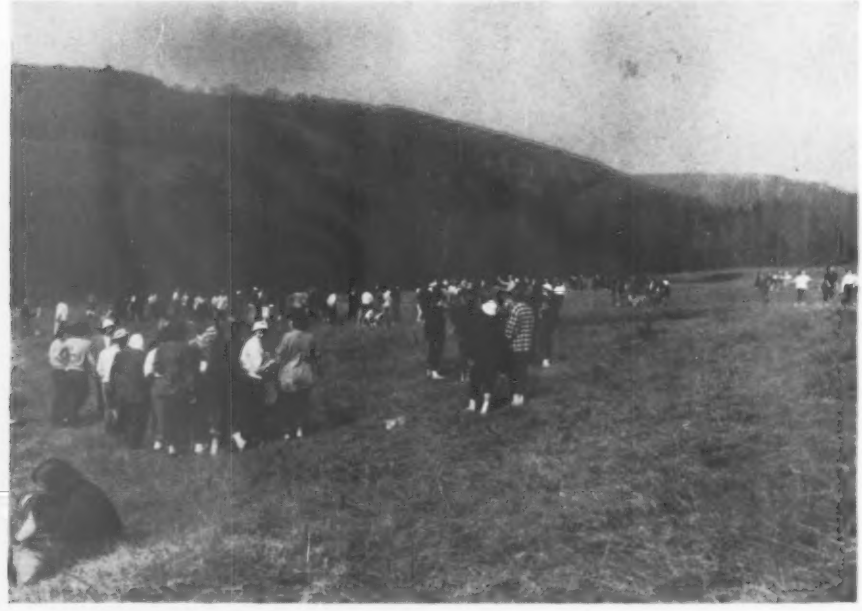
Prize-winning plaques.

"The Plow that Broke the Plains" produced by the Orchesis Club.

The activity that truly drew ''All out for Conservation'' was Tree-Planting Day, when 10,000 white pine seedlings were planted on sloping grasslands of the watershed of the Elmira Water Board. The Water Board supplied the mattocks and arranged for the delivery of the trees through the State Forester. The College girls contributed the energy required for the planting. One hundred fifty students were needed for the planting and two hundred and fifty volunteered. The College truck and private cars of faculty and town students furnished transportation. The dietitian provided box lunches for the student body. The time for Tree-Planting Day, a holiday from classes, was available because an extra day had been planned in the college calendar. The night before Tree-Planting Day the General Manager of the Elmira Water Board gave the students instructions for the planting at a special meeting on the campus. For the actual planting the students worked

Biology students conducting experiments in greenhouse plots as part of the all-college program on conservation of natural resources.

in threes. The first girl in a team of three made a hole through the sod and into the soil with a mattock; the second who carried a small carton of seedling trees placed a tree in the hole; the third pressed the soil around the tree with her heel. It was not necessary to water the seedlings because the ground was very wet. Snakes out for their first sunning of the spring caused the only interruptions to the routine of planting. In spite of distractions, the 10,000 seedlings were planted in just over two hours, after which the students were free for the remainder of the day. Tree-Planting Day was a happy and practical completion of the program on conservation of natural resources. Educationally, it may well have greater value than the public meetings and classroom activities of the conservation program. The trees are a growing, visible evidence of the efforts to make the students and citizens more aware of the problems of conservation. Let us hope that the growing of the trees will be symbolic of the increasing awareness of the student and the citizen to the problem of conservation of natural resources.



Students receiving instructions from the State Forester preparatory to the planting of 10,000 white pine seedlings on the watershed of the Elmira Water Board.

The Biology Fair

CARL L. AMUNDSON
Principal, Washington Park High School, Racine, Wisconsin

Yes, the project method is fine for most of the courses in high school. Most areas of work fit in neatly with adolescent interests. The result is a maximum of participation in activities because of a real desire to learn.

But what happens in the areas where natural interests and biological material do not coincide? The project becomes sterile, and the work rapidly degenerates to meaningless activities. Very little learning takes place, and interest and attitude drops to an all time low. Finally, in desperation, the teacher resorts to page assignments, with threats and grades as goads for carrying on activities which do not seem vital to high school students. It is a happy day when that unit of biology is completed.

There are two possible answers to this problem. One easy way out is to eliminate all of the biological material that seems lacking in appeal to adolescents. This could easily be done because there is an almost unlimited amount of material in biology. But many biology teachers are reluctant to admit that the only measure of importance for content in their course is its ready-made appeal to the youth in their classes. They have a feeling that some material has significance for their students' lives and helps them in understanding the world, even though it might not seem significant at the moment. They are, therefore, seeking means of teaching these areas effectively without resorting to methods which would permanently reduce their interest and future curiosity in the subject.

It was this problem that Jane Gordon, biology instructor at Washington Park High School, faced in considering a possible project approach to teaching *Fruits, Seeds, and Germination.* She felt that the concept of plant propagation was important in biology, and that to understand this there must be some understanding of fruits and seeds. She set up as some of her objectives for this project:

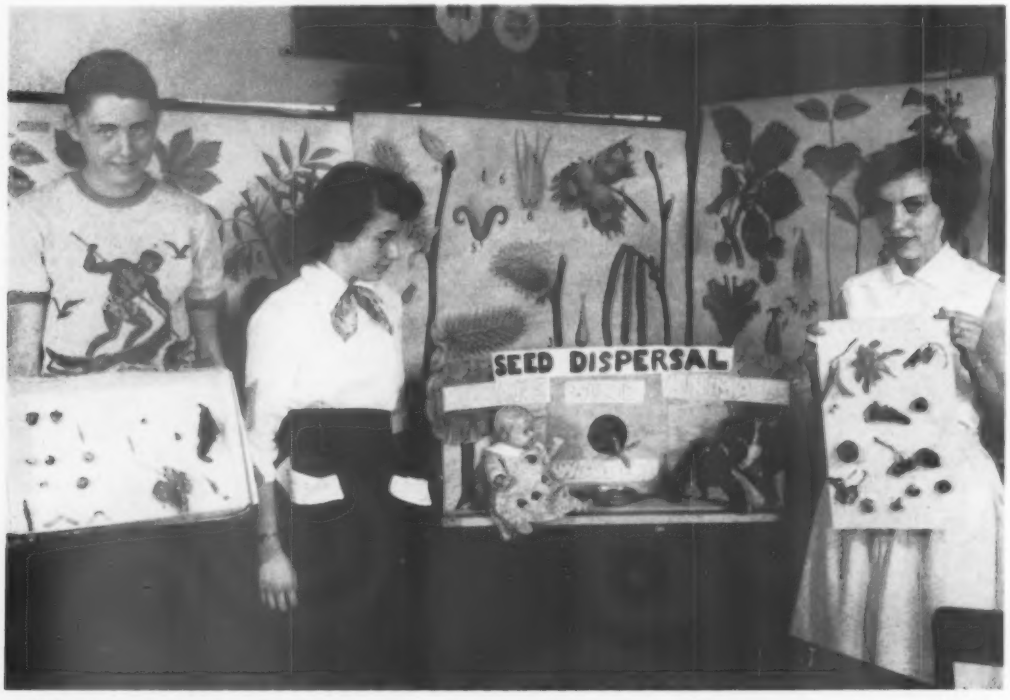
1. Create interest in plant propagation.
2. Become aware of and understand its applications in daily life.
3. Become familiar with fruits and seeds and their commercial importance.
4. Understand their biological structure for reproduction.
5. Develop desirable habits and attitudes in group work.

Obviously there wasn't much in the unit to make a direct appeal to a high school group on a project basis. In her opening discussion on the material, none of the suggestions made by students seemed to fire the enthusiasm of the group. When the students seemed to have exhausted all of their ideas, without finding anything suitable, Miss Gordon quietly suggested a fair.

This idea captured their imagination immediately. For those who had not seen a fair, others were eager to explain the displays of fruits and vegetables seen at our State Fair. They had many excellent ideas, but decided they would have to turn to their books for more information before they could arrange suitable exhibits. The teacher pointed out that this was not just a matter of displaying seeds and fruit, but that exhibits should be arranged to demonstrate biological facts.

There was considerable teacher direc-

tion during the time they were looking for ideas for a fair. Occasionally the search would be stopped for a discussion of the project by the class as a whole. Individual students would suggest displays that were criticized by the rest of the group. Finally small groups of students became interested in the same displays, and though suggestions were made from the entire class, the detail work was divided among those most interested. They were now busy printing signs, painting boxes for display purposes, dissecting seeds, making microscopic slides for projection work, and working on devices to demonstrate their principles to the rest of the class.



These were some of the more successful fair exhibits:

1. **Seed dispersal**—This was arranged on a $3' \times 4'$ tagboard for these seeds light enough to be attached. Appropriate descriptions of each were given on the tagboard. Also, a doll and toy dog were arranged to show the contribution of man and animals to seed dispersal. Finally, this group had a box arranged with a window to view the effects of wind induced by a fan on maple seeds and dandelion seeds.
2. **Germination**—Signs were used to attract interest, such as "Our corn will be sky high by the Fourth of July." Steps in the process of corn germination were labelled. Many types of seeds germinating were on display. Conditions necessary for germination were made graphic by a thermometer for warmth, a beaker of water for moisture, and a bottle of air for oxygen. The display also showed seeds germinating in air and water, and not germinating because of lack of water.
3. **Seed structure**—A balloon was painted to show parts of a bean. A plaster-of-paris model showed the cross section structure of corn. A micro-projector and microscope were set up to show various seed cross-sections under low power.
4. **Fruit display**—This was devoted primarily to fleshy fruits. This included poster displays and actual display of fruit according to classification and commercial use. There were also a table display showing food uses, and a cross-section display to show the remains of the flower.

The culminating activity of the course was Fair Day, when the projects they had been working on at home, after school, and during class were arranged for judging. It was agreed that exhibits should be judged on (1) time and effort put into the display, (2) educational value, (3) originality and (4) attractiveness. The entire class participated in the judging. They were so enthusiastic about their exhibits that they invited teachers and other classes to their fair.

Yes, there was waste motion in this unit of work, but if interest is important, then some of the waste motion can be justified. Students were talking about the fair in the cafeteria, the library, and groups peaked in the door as they passed by between classes. It was the topic of conversation for the day. The students who were in charge of their exhibits "knew their stuff." Not only did they have to know it to set up the exhibit, but they could explain their project for the judges and visitors.

This project was carried on weeks ago. Now, at the end of the semester, we wondered if they had only a passing interest in the project, or if it had made a more lasting impression. In order to find out, the students were asked at the end of the semester which project they had enjoyed most. The almost unanimous response was "The Fair." It had made a more effective impression on them than any other unit during the semester.

Students can become interested in the phases of biology which do not lend themselves naturally to the project approach. It takes considerable ingenuity on the part of the teacher, but it yields dividends in results. Time wasted on activities which do not contribute directly to learning biology is probably no greater than time lost by mental wanderings, so typical in the traditional procedure. All of biology can be fun and intensely interesting if we plan activities that are effective with our adolescents.

NATIONAL CONFERENCE ON PREMEDICAL EDUCATION

Medical and premedical advisers and educators interested in the problems of premedical education are invited to attend a National Conference on Premedical Education sponsored by Alpha Epsilon Delta, national premedical honor society, in cooperation with the Association of American Medical Colleges. The Conference will be held at the Lake Placid Club, Essex County, New York, on Saturday and Sunday, October 21–22, 1950, just prior to the annual meeting of the Association at the same place on October 23–25.

The Conference will not be planned as a formal meeting but will be organized as a workshop into round-table discussion groups consisting of both medical and premedical educators so that fruitful joint discussion can be held concerning the many problems of premedical education which involve both the liberal arts colleges and the medical schools. Each person in attendance will be expected to present general topics of mutual interest for discussion and raise questions for an exchange of ideas, opinions and suggestions concerning the various individual problems which confront the medical and premedical adviser. The meetings are being arranged under the direction of Dr. Hugh E. Setterfield, national president of Alpha Epsilon Delta, and Professor of Anatomy, Ohio State University College of Medicine.

Premedical advisers, teachers, and officials are invited to attend and participate in the Conference as there will be a large attendance in connection with the meetings of the Association of American Medical Colleges which should make it possible for exceedingly practical discussion in working out solutions for some of the major problems confronting the premedical adviser. For further details and information regarding the Conference address Alpha Epsilon Delta, 303 Upland Road, Havertown, Pa.

Editorial Comment

At the beginning of a school year, it is customary for the editor of an educational journal to make some sort of statement, setting forth the aims and policies of the journal. For *The American Biology Teacher* this is scarcely necessary, because the aims and policies have not changed since the establishment of the journal in 1938. The editorship has not changed since 1942.

Nevertheless, each year presents different problems and different approaches to old problems. At the beginning of this particular school year we find ourselves again involved in a shooting war. Almost anyone who had predicted five years ago that we would be shooting guns at an enemy in 1950 would have been called insane or worse; but here we are. The implications of this situation for biology teachers are too complicated to discuss in a short editorial, but at least they present problems and responsibilities for teaching citizenship that were not present a year ago. Biology teachers can be, and should be, and in many cases are, among the most important of the teachers of citizenship. Getting along in an enlightened age depends on understanding of the unity of mankind; this is biological at basis. The implications are manifold.

As always, the thought uppermost in the editor's mind is that the journal belongs to the readers. This statement is so trite that he hesitates to make it; it is so fundamental and far-reaching that he cannot refrain from making it once more. Only in the case of a few highly specialized kinds of journals is the editor in control. The readers, whether they know it or not, determine not only the policies, but also the procedures, selection of materials and advertising. To be sure, they usually do these things by indirection. How they do them is beside the point, however; the important thing is that the readers do control the magazine.

What can the readers do to help in the operation of the magazine? This question is often asked by teachers and other readers of *The American Biology Teacher*. They can do many things. They can read it and make use of such parts of it as fit the situations involved. They can recommend it to other teachers and to prospective teachers. They can make suggestions for improvement. They can make contributions, in the form of short notes, newsitems, pictures, laboratory techniques that have proved successful, or full length articles. They can make it a point to mention to advertisers that they learned of the advertised products through the ad in the journal. They can suggest to other firms that advertising in *The American Biology Teacher* reaches a large number of progressive biology teachers. They can assist in the always important task of recruitment of new members for THE NATIONAL ASSOCIATION OF BIOLOGY TEACHERS. They can see that their libraries know about *The American Biology Teacher* and take steps to get it on their shelves if it is not already there. They can write to the editor and tell him what they do or do not like about editorial policy or anything else about the magazine. This is only an incomplete list. Any intelligent reader can think of many more.

THE NATIONAL ASSOCIATION OF BIOLOGY TEACHERS is a relative young organization. It still needs a much larger membership. If biology is important teachers of biology must make it so. These teachers can gain much by association and cooperation in a nationwide

organization, and it is only by the banding together of a very large percentage of all the biology teachers of the country that the most can be gained. Increased membership also means increased funds available for the attainments of the purposes of the association.

JOHN BREUKELMAN

New Managing Editor

Miss Betty Lockwood, our hard working president, has taken over the duties of managing editor of *The American Biology Teacher,* replacing Irving Keene, who has served in that capacity for the past two years.

Miss Lockwood needs no introduction to readers of *The American Biology Teacher.* She has been a regular contributor from the beginning. Few, if any, members of THE NATIONAL ASSOCIATION OF BIOLOGY TEACHERS have done more to strengthen and increase the usefulness of the journal. We may be sure that her leadership will continue as it has in the past. The journal is most fortunate to have her in such an important position.

The entire staff of *The American Biology Teacher* takes this opportunity of welcoming Miss Lockwood to the managing editorship and also of thanking Mr. Keene for the service rendered during the past two years.

ACHIEVEMENT MEDAL IN SCIENCE

Clyde T. Reed, Educator, successful Professor, Scientist: your good work beyond your scheduled duties, your industrious research in areas of Science outside of textbook materials, your contribution to the University in building up our biological and botanical laboratories far beyond those of most colleges in our class, your effective contributions to the progress of science and scientific organizations in Florida, have brought you to an advanced position among your fellow scientists throughout the country.

As a token of the University's gratitude for your many services and contributions to its efficiency and status among institutions of higher learning, I am happy to present to you the University of Tampa Achievement Medal in Science.

Editor's note: Professor Reed is a long time member of NABT and a strong supporter of the journal. *The American Biology Teacher* adds its congratulations.

AMERICAN YOUTH HOSTELS are continually planning trips of interest to students, and biology teachers. Details of itineraries and costs of trips are available from AYH National Headquarters, 6 East 39th Street, New York.

FREE TEACHING AIDS. *The Chicago Schools Journal* has issued a Supplement for October 1949. It contains thirty-two pages listing about twenty separate sources to the page. The title of the work is "Free and Inexpensive Teaching Aids for the Science Teacher." About two fifths of the materials listed is suitable for biology instruction. There are sufficient materials listed to build a year course in biology. The editorial offices are located at Chicago Teachers College, 6800 Stewart Avenue, Chicago 21.

STATE FLOWERS. A very excellent wall chart, with a 1950 copyright, is available from *Womans Day Incorporated,* 19 West 44th Street, New York 18, N.Y.

PICTORIAL BULLETINS, 14″×17″ posters. Excellent for science bulletin boards, mailed twice a month to teachers requesting them. Also—Great Men of Electrical Engineering. Free. Write for both services—School Service, Westinghouse Electric Corporation, 306 Fourth Avenue, Pittsburgh 30, Pa.

ACCENT ON TEACHING, 16 mm sound film, Ohio State University, Columbus, Ohio. This film shows the difference in effective and ineffective teaching; it is of interest to high school and college teachers.

THE OLD FOSSIL. Still at the same old stand. Send in your ideas for column suggestions to The Old Fossil, 5061 North St. Louis Avenue, Chicago 25, Illinois.

Vitamin B_{12}—A Nutritional Factor for Man and Beast*

CHARLES W. MUSHETT
Merck Institute for Therapeutic Research, Rahway, New Jersey

One hundred years ago Thomas Addison (1) recognized as a clinical entity the disease known as pernicious anemia. The anemia is characterized by insidious onset, by the presence of abnormally large red blood cells, a deficiency of gastric secretion, and certain gastrointestinal and neurologic disturbances. The designation, "pernicious", which implies a fatal outcome, has become inadequate since the advent of liver therapy. It was in 1926 that Minot and Murphy (2) made the important observation that the feeding of whole liver to patients with pernicious anemia results in a relatively rapid remission of most symptoms, only those due to irreversible pathologic changes occurring before liver therapy being refractory to such treatment. Experimental evidence for the value of liver had been demonstrated the year before by Whipple (3) in dogs with hemorrhagic anemia. Although pernicious anemia had been considered by most clinicians as being due to a toxic or infectious agent, it now appeared that a deficiency of a nutritional factor was the cause of the disease.

Subsequent studies by Castle and associates (4) clarified somewhat the relationship of food to pernicious anemia. Castle postulated that certain fods, such as eggs or lean beef, contained an "extrinsic" factor which when acted upon by the "intrinsic" factor, secreted by the normal stomach, yielded the erythrocyte maturation factor or anti-pernicious anemia factor, which was then stored in the liver. The basic defect in a patient with pernicious anemia is an inability to produce intrinsic factor in the stomach. If gastric juice from a normal person (containing intrinsic factor) is incubated with beef muscle or another source of extrinsic factor and then administered to a pernicious anemia patient a satisfactory clinical response is obtained just as when liver itself is given.

With the knowledge that liver is effective in the treatment of pernicious anemia, investigators from all over the world set out to isolate and identify the active principle therein. Concentrates were made which reduced considerably the size of the dose needed. Some patients, however, objected to the unpalatability of the concentrates as much as they had to the large amounts of whole liver which had to be taken by mouth. Finally it was posible to prepare highly refined liver extracts which were much less expensive than liver itself and which could be given by injection. A more accurate dose could be given by injection and the response by this route of administration was found to be more rapid than when liver or liver preparations were given orally. Furthermore treatment could be given at intervals of two or more weeks instead of daily.

In recent years a crystalline vitamin of the B-complex, called pteroylglutamic acid or "folic acid" was isolated and then synthesized. This was found to be effective in the treatment of the anemia of pernicious anemia, sprue and nutritional macrocytic anemia. Used in milligram doses it brought about a rise in the

* Presented before Joint Session of the Science Teaching Societies, American Association for the Advancement of Science, December 28, 1949, New York City.

reticulocytes of the blood, followed by an increase in erythrocytes. The majority opinion of clinicians, however, is that pteroylglutamic acid neither prevents nor controls the process of neurologic degeneration in patients with pernicious anemia. It likewise does not cure the lesions of the tongue in this disease. Aside from its incomplete therapeutic value it early became evident that pteroylglutamic acid was not the principal constituent in liver which effectively controls the symptoms in pernicious anemia. Although it could be calculated that the anti-anemic principle in liver was present in extremely small amounts, the content of pteroylglutamic acid in potent liver extracts was much too low to account for the activity observed.

The progress of chemists in isolating the antianemia factor was slow, primarily because the innumerable liver fractions they prepared had to be assayed in patients with untreated pernicious anemia. Animal tests and tissue culture tests for the principle were found to be too unreliable or too nonspecific. In 1946 Cary and co-workers (5) noted that rats required for growth, in addition to the then known nutrients, a new factor called "X" which was present, among other sources, in certain liver extracts. The following year Shorb (6) reported that the microorganism *Lactobacillus lactis* Dorner required two unidentified factors for optimal growth. One of these factors was found in highest amount in liver extracts. This was called LLD factor. Shorb's further studies revealed that the activity of refined liver extracts for producing growth in the test microorganism was directly related to the potency in treating patients with pernicious anemia, thus suggesting that the principal factor involved in the two processes might be one and the same.

Chemical fractionation studies on liver extracts, which, guided by an occasional clinical trial, had been going on for years in the Research Laboratories of MERCK & CO., Inc., were now accelerated due to the availability of the microbiological assay. On April 16, 1948, the research team of Rickes, Brink, Koniuszy, Wood and Folkers (7) announced the isolation, from clinically active liver concentrates, of a minute amount of a red crystalline material which they tentatively called vitamin B_{12}. When sufficient information on the structure of the molecule is known, the vitamin will undoubtedly be given a more descriptive name, a procedure followed in the case of other vitamins of the B-complex. Vitamin B_{12} was found by Shorb (8) to have extremely high LLD activity for the microorganism *Lactobacillus lactis* Dorner. West (9) demonstrated, furthermore, that this vitamin, in microgram quantities, brought about a favorable response in the blood picture of patients with pernicious anemia. It appeared even at this early time that vitamin B_{12} was the most potent hematopoietic agent introduced to the field of medicine.

A week after the appearance of the paper by Rickes and associates, Lester Smith (10) of the Glaxo Laboratories in England reported that two cobalt-colored, amorphous pigments had been obtained from ox liver. The chemical and physical properties of these still impure pigments suggested a similarity to vitamin B_{12}. The material was found active in stimulating blood regeneration and in improving the neurologic status in cases of pernicious anemia. Shortly thereafter, workers in the same laboratory succeeded in obtaining red crystals which they thought might be identical with vitamin B_{12}. A crystalline anti-pernicious anemia factor has also been isolated by a group of workers from the laboratories of the British Drug Houses in England. Comparisons made on

samples of the materials from the two British groups and from the American group have revealed that these are identical; all three compounds are crystalline vitamin B_{12}.

In a continued search for source materials from which vitamin B_{12} could be made, Rickes and co-workers (11) found that the culture broths from several strains of microorganisms showed LLD activity. They isolated from the broth of a grisein-producing strain of *Streptomyces griseus,* a red crystalline material which, upon subsequent chemical, physical and clinical tests, proved to be vitamin B_{12}. Although the initial yield was low, it appeared reasonable to assume that future developments in culture methods and in extraction and purification procedures would result in the greater availability of this potent vitamin. Today the practical production of vitamin B_{12} by fermentation processes is a reality.

As more vitamin B_{12} was made available to clinical investigators, additional reports apeared on the efficacy of this substance in elevating the numbers of circulating normal red blood cells and total hemoglobin content in the blood of patients with pernicious anemia. It became evident also that, concomitantly with the increase of red blood cells, the numbers of platelets and white blood cells also increased in those patients in whom they were subnormal prior to treatment. The property of vitamin B_{12} to bring about the production of all types of blood elements would justify the statement that it is a panhematopoietic stimulus. Hall (12), in a study of bone marrow removed from the sternum of pernicious anemia patients at various intervals, showed that a rapid shift takes place in the type of red blood cell progenitors following treatment with vitamin B_{12}. The characteristic megaloblasts which are present in the bone marrow of such patients are replaced by normoblasts, the cell type found in normal marrow. The latter then develop into normal red blood cells. Distinct bone marrow changes were evident as early as nine hours after a single injection of vitamin B_{12} and virtually complete conversion to normal occurred within forty-eight hours.

The neurologic manifestations of pernicious anemia, including peripheral neuritis, ataxia and abnormalities of vibration sense, were found by clinical investigators to respond to vitamin B_{12} in the same manner as previously noted for potent liver extracts. The specificity of response is well illustrated in a case reported by Berk and collaborators (13). During the course of one week's treatment with vitamin B_{12} the patient under consideration, who had previously exhibited severe neurologic symptoms, showed a dramatic clinical improvement both in blood picture and in neurologic status. Due to a delay in delivery of vitamin B_{12} to the hospital, treatment had to be discontinued for several days. As a result the neurologic symptoms reappeared. Further treatment again brought about a remission of symptoms. The gastro-intestinal symptoms of pernicious anemia, including soreness or burning of the tongue, are relieved promptly upon the institution of vitamin B_{12} therapy. Regeneration of the papillae of the tongue takes place within a relatively short time. With the disappearance of the gastro-intestinal symptoms there occur improvement in strength, mental alertness and appetite and gain in body weight.

Vitamin B_{12} has been shown also to be active in correcting macrocytic anemias other than Addisonian pernicious anemia. Reports from several clinics reveal that vitamin B_{12} is capable of producing a satisfactory hematologic response in patients with tropical sprue,

non-tropical sprue, nutritional macrocytic anemia and certain cases of macrocytic anemia of infancy.

The potency of extracts of liver or stomach mucosa with clinical efficacy in pernicious anemia has been expressed for standardization purposes in terms of U.S.P. units. One U.S.P. unit is that quantity of a given preparation which is required daily to bring about satisfactory clinical and hematological responses in classical pernicious anemia. Evidence from many sources suggest that one microgram (0.000001 gram) of crystalline vitamin B_{12} is approximately equivalent to 1 U.S.P. unit. Spies and co-workers (14) have conducted certain clinical investigations on macrocytic anemia with the purpose of establishing the relative efficacy of the three crystalline compounds, thymine, pteroylglutamic (folic) acid and vitamin B_{12}. They found that to produce a satisfactory hematologic response the dose of thymine needed is several thousand times that of folic acid, which in turn is several thousand times the amount of vitamin B_{12} required. Although all three compounds affect the blood picture in a beneficial manner, only one of them, vitamin B_{12}, is capable of bringing about a remission of the gastro-intestinal and neurological symptoms in pernicious anemia. Several clinicians have shown that when a folic acid antagonist, a compound capable of neutralizing folic acid activity in the body, is given along with vitamin B_{12} to a patient with pernicious anemia, the B_{12} appears to be incapable of exerting its usual effect. Data of this nature suggest that folic acid must be present in the body in order for vitamin B_{12} to act efficiently.

It was stated earlier that vitamin B_{12} is produced by microorganisms such as *Streptomyces griseus*. Numerous types of microorganisms flourish in the intestinal tract of both men and animals and observations from various authors early indicated that these may produce substances of benefit to their hosts. Stokstad and associates (15) have isolated an organism from chicken feces which produces a substance having growth activity for chicks and antipernicious anemia activity in man. As a follow-up on this line of thought, Bethell (16) assayed the feces of patients with pernicious anemia in relapse and found them to have high content of a growth-stimulating factor for *Lactobacillus lactis* Dorner, the test organism used for B_{12} assays. It was estimated that the daily fecal output of B_{12} by a patient with pernicious anemia may be several times his requirement for the vitamin. It seems enigmatic that nature should permit such a physiologic condition to exist, namely the discarding in the excreta of a substance for which there is such a dire need. The defect would appear to be in absorption of the active material from the intestinal tract. Evidence suggesting that this might be so comes from other clinical work. It has been shown by Berk and associates (17) as well as by other investigators that a dose of vitamin B_{12} which is effective by intramuscular injection, may not be effective if given by mouth. In fact, about thirty to fifty times as much must be given by mouth, according to Spies (18). Berk and co-workers (17) reported that a positive response could be obtained, however, when a relatively small dose of vitamin B_{12} was given orally along with normal human gastric juice. They suggested, therefore, that a function of the gastric juice (containing intrinsic factor) is to facilitate the absorption by the intestine of vitamin B_{12} or chemically related compounds in the food.

Aside from its clinical efficacy in the treatment of certain macrocytic anemias,

vitamin B_{12} exerts a potent action in promoting growth. Indeed, the microbiological assays for this vitamin are based upon its growth-promoting property for *Lactobacillus lactis* Dorner and other microorganisms. Shortly after Rickes and associates published on the isolation of crystalline vitamin B_{12}, Ott and coworkers (19) reported that this compound accelerates the rate of growth in chicks on a purified diet devoid of animal protein. Supplementation of the test diet with as little as 30 micrograms per kilogram of food (30 parts per billion) produced maximal growth effects. Emerson (20) has reported that the growth-depressing action of thyroid powder in rats is counteracted by vitamin B_{12} administered by either the oral or subcutaneous route. Nichol and coworkers (21) have demonstrated a similar effect of this vitamin in the chick. Hartman and associates (22) have presented evidence indicating that vitamin B_{12} plays a fundamental role affecting the capacity of the normal mammal to utilize protein. These authors believe that vitamin B_{12} probably influences the processes of reproduction and lactation. In several species, at least, it appears that vitamin B_{12} is transmitted to the nursing young through the milk. The laying hen presumably contributes a store of the vitamin to the egg. The role played by vitamin B_{12} during the intrauterine development of the human fetus and during the suckling period of the infant has yet to be elucidated.

The term "animal protein factor" or simply APF has been used to designate growth factors present in animal products such as fish meal, milk and liver. Animal protein factor is required by rats, mice, chicks, pigs and other species. In addition to its growth effect, it has been shown to be important in reproduction and lactation in mammals and in hatchability of hen's eggs and subsequent viability of chicks. Although vitamin B_{12} has not yet been tested under all the varied conditions in which "animal protein factor" is effective, nevertheless experimental data in chicks, rats and possibly in pigs indicate that vitamin B_{12} shows "animal protein factor" activity, at least with certain dietary conditions. That factors other than vitamin B_{12} are also present in sources of APF may yet be demonstrated. It is not unlikely that vitamin B_{12} is present in such sources in more than one chemical form. The B_{12}-APF relationship has attracted the attention of many investigators and additional clarification is to be expected in the future.

A recent paper by Wetzel and associates (23) has focused the attention of clinicians on the role of vitamin B_{12} in promoting growth in school children. Following a control period, during which the growth behavior and appetite were closely observed, eleven children, ranging in age from five to twelve years, were given daily oral doses of 10 micrograms of crystalline vitamin B_{12}. A dramatic response occurred in five of the eleven children, the effects being objectively measured by gains in physique and development. Changes observable after B_{12} treatment were, according to the authors, "those of increased physical vigor, alertness, better general behavior, but above all a definite increase in appetite manifested by demands for 'second helpings' as contrasted with comparatively indolent food habits before." Although the number of individuals treated was small, the beneficial results were found to be statistically significant. Studies of similar nature are in progress in several clinics and the outcome of these should provide a more rational basis for the feeding of growing children.

Investigations on the chemical nature of vitamin B_{12} are being conducted in a

number of laboratories. The red color of vitamin B_{12} crystals is due principally to its content of cobalt which is about 4–4.5%. Rickes and co-workers (24) consider the molecule to be a cobalt coordination complex. The molecular weight of B_{12} appears to be in the range 1300–1500. Although it contains nitrogen and phosphorus, no sulfur has been detected. In alkaline or acid solutions its activity for microorganisms is decreased, but it can be autoclaved for the purpose of sterilization in neutral aqueous solution without loss of activity. Vitamin B_{12} is optically active, and as shown by titration in glacial acetic acid, is a polyacidic base. Microanalyses of vitamin B_{12}, reported by Brink and associates (25), shows it to have a composition typified by $C_{61\text{-}64}H_{86\text{-}92}N_{14}O_{13}PC_0$. The formulas $C_{62}H_{86\text{-}90}N_{14}O_{13}PC_0$ and $C_{63}H_{88\text{-}92}N_{14}O_{13}PC_0$ agree rather well with analytical data. Since upon hydrolysis vitamin B_{12} does not liberate alpha amino acids it is not a peptide. Products are formed from alkali fusion of vitamin B_{12} which show reactions characteristic of certain compounds such as pyrroles. Brink and Folkers (26) found that B_{12}, upon acid hydrolysis, yields 5,6-dimethylbenzimidazole. A chemical relationship between vitamin B_{12} and riboflavin (vitamin B_2) is thus indicated.

By means of catalytic hydrogenation, Kaczka and associates (27) have converted vitamin B_{12} into another red crystalline compound, vitamin B_{12a}. This has been shown to possess growth factor activity for chicks and rats and to be of value in the treatment of pernicious anemia. Analytical data for vitamin B_{12a} and B_{12} are quite similar but these two compounds differ in the susceptibility to alterations in their absorption spectra with changes in pH as well as in their stability to heat. Still another red crystalline compound, B_{12b}, which can be differentiated from vitamin B_{12} by its ultraviolet and visible absorption spectra, has been isolated from cultures of *Streptomyces aureofaciens* by Pierce and co-workers (28). This, too, shows biological activity akin to vitamin B_{12}. Folkers (29), on the basis of recent chemical investigations, feels that vitamin B_{12b} is identical with vitamin B_{12a}. Studies in man, animals and microorganisms indicate the same degree of potency for vitamin B_{12} and $B_{12a} = B_{12b}$.

Ample evidence has been presented to show that crystalline vitamin B_{12} is an extremely potent compound, capable of bringing about a hematopoietic response in several different types of macrocytic anemia and improvement in the neurologic and gastro-intestinal status of patients with Addisonian pernicious anemia. That it has growth-promoting activity has been shown for several laboratory animals and livestock. It appears likely from preliminary studies that vitamin B_{12} is intimately concerned with growth and development in man. Undoubtedly, additional uses for the vitamin will be demonstrated.

Recent experimental data indicating that vitamin B_{12} can replace certain lipotropic factors and thus protect rats on experimental diets from damage to the kidneys, can partially protect the livers of rats from the poisonous effects of carbon tetrachloride and can reduce the incidence and severity of gizzard erosions in chicks fed a diet devoid of animal protein, provide fuel for speculation on the potential usefulness of vitamin B_{12} as a nutritional and therapeutic agent.

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Books

Clements, Frederic E., Martin, Emmett V., and Long, Frances L., *Adaptation and Origin in the Plant World.* The Chronica Botanica Co., Waltham, Mass. xii + 332 pp. illus. 1950. $6.00

This monograph on the role of environment in evolution by the late Dr. Frederic E. Clements and his collaborators Drs. Martin and Long, with illustrations and drawings by Edith S. Clements is an account of the original researches into the nature of plant species and the results obtained through forty years of experiments in ecological analysis and synthesis.

The ruling principle of dynamic ecology is change in the organism and the community. Experiments on these changes have constituted the primary objective of the present studies in discovering the various types and their relation to the environment. This excellent monograph, profusely illustrated, treats the three primary methods for producing modifications: (1) transferring the plant to a different habitat, ranging from the clisere of climates to be found at the three Pikes Peak, Colorado, gardens, 6,000, 8,000, and 12,000 ft. respectively, to the two gardens of subtropical and marine climates at Santa Barbara, California, (2) modifying the habitat or one controlling factor by having each climatic garden comprising several edaphic ones in which one factor was controlled, (3) disturbing the nutritional balance in the plant body by increase or decrease of food to a particular organ or part or with an upset of the bio-chemical balance.

The wealth of previously unpublished data on experimental ecology and morphogeny, the large number of illustrations, many in color, the 63 pages of text figures, the many excellent detailed graphs and tables make this a must in every high school and college library and the book that every ecologist and scientist interested in the role of environment in evolution will want to own.

Charles C. Herbst,
Beverly Hills High School,
Beverly Hills, California

Walter, Herbert E. and Sayles, Leonard P., *Biology of the Vertebrates.* 3rd. ed. The MacMillan Company, New York, vi & 831 pp. illus., 729. 1949. $6.00

In this third edition Mr. Sayles has ably taken up the pen laid down by Mr. Walter, who had drawn so much humor into the earlier editions through the fascinating study of vertebrates. This textbook is a comparative study of man and his animal allies. The early development of chordates, their classification, their relation in time and space, and their fundamental structures are presented as background information, following which the physiologic functions of vertebrates are used as a basis of describing structures. These are related first to the human body and then compared with other vertebrates.

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Ruth A. Dodge,
Past President,
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Blake, Emmet, R., *Preserving Birds for Study.* Chicago Natural History Museum. 38 pp. illus. paper bound. 1949. 30¢.

This excellent little book is simply written, well illustrated, carefully arranged and organized so that the reader can find the points he wants. The sections come in logical order; there are precautions about things that cause trouble; the steps are numbered. The booklet should be in the hands of everyone who has occasion to make study skins.

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